A Trade Policy Perspective On Import Quotas And The Substitution Effect

Cadogan, Godfrey

Institute for Innovation and Technology Management, Ryerson University

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by

Godfrey Cadogan*

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* Corresponding address: Information Technology in Finance, Institute for Innovation and Technology Management, Ted Rogers School of Management, Reyerson University, 575 Bay, Toronto, ON M5G 2C5; e-mail: gocadog@gmail.com. This paper was completed while the author was at the University of Michigan, Department of Economics. I thank Jim Levinsohn for his comments on earlier drafts of this paper, and Sean MacAlinden at OSAT-UMTRI for several useful conversations on the political economy of the U.S. automobile industry. Available at SSRN eLibrary http://ssrn.com/abstract=1679513. This paper is a revision of an earlier paper entitled "A Trade Policy Perspective On Import Quotas And The Substitution Effect in the U.S. Automobile Industry".

A Trade Policy Perspective On Import Quotas And The Substitution Effect

ABSTRACT

This paper focuses on the necessary conditions required in order to exploit the substitution effect which arises when there is a shift in demand induced by import quotas under imperfect competition. The protective policy succeeds if the substitution effect shifts in favor of goods produced by the domestic industry and this shift offsets foreign firms quota rents and the decrease in consumer welfare. While extant literature tends to focus on welfare loss associated with import quotas, in this paper social welfare analytics are produced and a trade policy decision rule for net welfare gain is obtained.

Keywords: Import quota, social welfare, substitution effect, trade policy decision rule.

JEL Classification: F13

I. INTRODUCTION

One of the most salient characteristics of an import quota is that it is a restriction on quantity and not a restriction on price. Hence the profit maximizing manufacturer would want to exploit maximal revenue opportunities within the framework of quantity restrictions. Feenstra (1988) and Morke & Tarr (1984) have shown that the imposition of a quota--in this case a voluntary export restraint (VER)--led Japanese automobile manufacturers to export higher quality cars at higher prices in order to offset the forgone profits incurred from the imposition of VER[1]. Hence the advent of a quota shifts the demand curve in favor of the relatively more affluent consumer and thus forces the displaced consumer to seek substitutes for those cars which are no longer available. This substitution can take the form of other imports or domestic automobiles

[1]"...**A major puzzle for the political economy of trade policy is to explain why such a seemingly self-punishing policy should have become the protectionist measure of choice in the last two decades...**", Helpman & Krugman (1989), pg 14.

which are competitively priced vis-a-vis the pre-quota restriction on imports. This paper focuses on the impact on of an import quota on domestic sales[2]. Even though the abstract model is applicable to import quotas in general, we use the applied setting of the pre-GATT 1994 U.S. automobile industry because it is the largest manufacturing sector in the U.S.. It assumes that a car is a durable good that is long lived. As a result relationship(s) exist between the market for new and used versions of the good. For example, the price that a car dealer gets depends not only on the current stock of new cars but also on consumer expectations about future stocks and their ability to trade in the secondary or used car market. However, an automobile also depreciates and this leads to the need for new replacement. A domestically made car is assumed to be substituted for a foreign car in each case.

Another impact of VERs would cause some consumers to purchase an automobile and hold it for a short period knowing that it could be resold in the used car market at anytime thereafter. The consumer stands to gain a premium if the real resale value is higher than the value of the car net of depreciation. Other consumers may postpone their consumption (purchase) of a new car and under extenuating circumstances they would elect to buy a "good used car" during the transition period between getting rid of the "old car" and the purchase of the new one. This scenario could be viewed as an intertemporal effect of smoothing consumption of a durable good - new cars. That is, a new car is bought and it begins to depreciate in market value since it cannot be stored[3]. The moment that the consumer decides to get a new car, if consumption is postponed because the de facto rationing of previously available cars "prices out" the consumer, then from that moment on the consumer is forced to drive a vehicle that he/she wants to replace but is liquidity constrained to keep. In that case, the

[2] A recent paper by Raff and Wagner (2009) examined the impact of import penetration on an oligopoly, and found that in the short run the more efficient firms remain competitive. However, in their model these effects disappear in the long run. In the oligopolistic model of Berry, et al. (1999) consumers tend to suffer welfare losses with volunteer export restraints.

[3] Assume that this is not a collector's item or a vintage automobile that appreciates in value during the storage period.

effect is the same as buying a "good used car" until a new one can be bought. This stylized model will result in welfare and deadweight loss since other things being equal, the consumer is now at a lower demand curve and derives less utility from the old (used) car.

Section II discusses the model and assumptions. It is essentially a neoclassical model of imperfect competition, and partial equilibrium between firm and consumer. Fairly standard parametrization and approximation procedures are used to derive an estimate of the substitution effect. Section III analyzes the welfare effects of the import quota and derives a necessary condition for a naive policy maker's belief that an import quota would be welfare improving or at least welfare neutral. Section IV is the summary and it highlights issues for consideration in empirical implementation of the results in this paper. Details about parametrization and deduction of equations are contained in the Appendix.

II. THE MODEL

The model is based on "symmetric substitution"[4]. It is a somewhat neoclassical model that uses the convexity of indifference contours over brands (domestic and foreign) to consumer preference for variety. It is assumed that high quality firms allocate more resources to quality control vis-a-vis low quality firms. Thus a smaller variance and greater average quality implies a higher marginal cost. The production of more units would lead to diminishing returns to investment in quality control beyond some point since economies of scale mitigate against the competitive firm's ability to provide more goods, other things being equal.

Consumer beliefs about quality will be based on imperfect information to some extent since advertising, sampling costs and "word-of-mouth" communications would introduce a certain element of uncertainty in the model. These sources of randomness in quality have led automobile manufacturers to offer more comprehensive warranties and consumer incentives to in effect signal quality. We assume that manufacturers are

[4] See Krouse (1990), pp 165.

faced with a self enforcing mechanism of firm reputation so that they will not knowingly palm off low quality goods at a high price[5]. We assume that products can differ only along a single quality dimension and that at a given price all consumers prefer more quality to less. That is, consumers are non-satiated in quality. It is assumed everywhere that the good in question is an automobile.

Goods characteristics

Consider a good, j, that is comprised of a characteristic vector $\mathbf{z}_j = (z_{j1}, z_{j2}, \ldots, z_{jN})$. Here z_{jn} is the amount of characteristic n in good j, n=1,2,...,N. Let α_j be a design parameter such that changes in α_j results in changes in z_j. Hence $z_{jn}(\alpha_j)$ reflects the impact of a design change in good j on characteristic n. We assume that $z_\alpha = z'(\alpha) > 0$ [6]

Consumer market

Assume that consumers have quasi-convex preferences and that they are nonsatiated in quality. A representative consumer has an aggregate separable utility function[7] given by:

$$U(\mathbf{z}, z_0) = u\left(\sum_j z_j^{\sigma}\right) + z_0, \quad 0<\sigma<1$$

The inequality implies that z_j's are imperfect substitutes and that more variety leads to higher consumer utility. z_0 is a numeraire good and $\mathbf{z}$ is an N-vector of characteristics such that $\mathbf{z} = (z_1, z_2, \ldots, z_N)$. One commonly used parametrization is the Constant Elasticity of Substitution (CES) form of the utility function,

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[5] See Akerlof (1970) and Leland (1979) for quality pricing with imperfect information.

[6] This assumption is reasonable since it implies that improvements in design leads to higher quality or at least an enlargement of the characteristic set.

[7] See Dixit & Stiglitz (1977).

$$U(\mathbf{z}, z_0) = \left(\sum_j z_j^{\sigma}\right)^{\theta} + z_0, \quad 0<\theta<1.$$

This implies that the CES between any two characteristics is given by $\delta = \frac{1}{1-\sigma}$ and $0<\sigma<1$ implies imperfect substitution between any two characteristics. Since $0<\theta<1$, there is declining marginal utility for each feature relative to all other features[8]. The change of variable $v_j = z_j^{\sigma}$ and $\mathbf{v} = \sum_j v_j$ suggests that $\mathbf{v}$ is a composite features index associated with the product chosen by a given consumer.

Demand equations[9]

The inverse demand function is derived from the first order conditions for consumer utility maximization. It utilizes constant marginal utility for the numeraire good and the marginal rate of substitution for characteristics (see Appendix I); z(.) is the quantity demanded and p(.) is the corresponding price; **p** and **z** are N-vectors of prices and characteristics, respectively (see Appendix II, Figure 1); y is the income associated with the numeraire good z_0 (i.e $y = p_0 z_0$).

The firm

The foreign firm is faced with the domestic demand $p(\mathbf{z}, y)$ [10] for its product , a VER, M, and a cost curve $C(M, \mathbf{z}(\boldsymbol{\alpha}))$[11]. Feenstra (1988) proposed a class of homothetic cost functions with *decreasing marginal cost* for some characteristics when there is an *increase in output*. He postulated that the firm would find itself with unused fixed inputs when demand

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[8] $p_j(.) = \frac{dU(.)}{dz_j} = \sigma\theta\left(\sum_j z_j^{\sigma}\right)^{\theta-1} z_j^{\sigma-1}$, implies a declining rate in z_j

[9] Note that Breshahan (1981) developed a model for consumer demand for quality in the automotive industry by using a slightly different scheme.

[10] Technically, the composition of characteristics of the z-vector for domestic and foreign cars are different due to the design parameter α.

[11] See Epple (1987) for further characteristics.

decreases due to the VER. This indicates that the firm moves along its cost curve to adjust for unused input capacity. That is, it upgrades the cars it produces with the previously unused inputs. Here we assume that domestic firms are faced with similar cost and demand functions. Domestic firms are assumed to be competitive.

The Substitution Effect[12]

Let $z(\mathbf{p},y)$ be the demand for cars before the imposition of a quota[13]. In the advent of a quota, $\overline{M}$, the price of cars increase from $\mathbf{p}$ to $\mathbf{p}'$ and the new demand $z(\mathbf{p}',y;\overline{M})$[14] goes down. The compensating income required to allow the consumer to maintain her original level of demand is given by $\Delta y = z(\mathbf{p},y).(\mathbf{p}' - \mathbf{p}) = z(\mathbf{p},y)\Delta\mathbf{p}$. The amount of cars to be substituted is given by:

$$\Delta z^S(.;\overline{M}) = z(\mathbf{p}',y+\Delta y) - z(\mathbf{p},y).^{15} \qquad \textbf{[1]}$$

III. Welfare Effects

Assume that a certain fraction, β[16], of the substitution effect goes to domestic producers. Then domestic sales increase by $\beta\Delta z^S(.)$. In order for the quota to have at least a neutral effect on social welfare in the Bergsonian sense, the profits generated by the increase in domestic sales must offset the decrease in consumer surplus induced by the price increase

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12 The computation of the substitution effect in this section is motivated by Varian (1990).

13 $p(\mathbf{z})$ is the inverse demand corresponding to $z(\mathbf{p},y)$ where y is consumer income

14 It is important to note that here that the policy variable, $\overline{M}$, is a shift parameter for the demand curve.

15 There is also an income effect $\Delta z^I = z(\mathbf{p}',y) - z(\mathbf{p}',y+\Delta y)$. However, this effect will not be analyzed here.

16 We can assume that β. is a function of cross elasticity of demand between imports and exports or perhaps more appropriately domestic goods.

from demand shift and the quota rents that accrue to the foreign firms as a result of the VER. The welfare accounting for this stylized model of a naive import quota policy, endogenously determines an *optimal* VER.

Let W_L be the welfare loss due to the VER. The welfare loss consists of the decrease in consumer surplus and the quota rents that accrue to foreign firms. The welfare gain, W_G, comprises the increase in producer surplus (profits). The import quota is at least welfare neutral, if $W_G >= W_L$.

Social welfare analytics will proceed along the envelope of consumer utility and firm profit functions (see Appendix II, Figure 2). Hence we assume that after firms adjust their output levels to maximize profits and individuals move to optimize utility, the variable parameters are the endogenously determined import quota, $\overline{M}$, and its concomitant design parameter, α.

Let $W_G^* = \psi\Delta z^s(\overline{M},\alpha)$ for some optimal level of firm profit and consumer utility. Here ψ is a constant that incorporates the proportion, β, and the constant share of profits that accrue to domestic firms. Similarly, let $W_L^* = \lambda(\overline{M},\alpha)\overline{M} + CS^0(\alpha) - CS^1(\alpha)$ [17]. If we totally differentiate so that $dW_G^* >= dW_L^*$, we get the following:

$$\psi[d(\Delta z^s(\overline{M},\alpha))] >= \lambda d\overline{M} + \overline{M}\,d\lambda + CS^0_\alpha d\alpha - CS^1_\alpha d\alpha - CS^1_{\overline{M}} d\overline{M} \qquad \textbf{[2]}$$

After some manipulation this relation reduces to:

$$\frac{d\overline{M}}{d\alpha}\left(\psi\frac{d\Delta z^s}{d\overline{M}} - \lambda - \lambda_{\overline{M}} + CS^1_{\overline{M}}\right) >= \overline{M}\lambda_\alpha + CS^0_\alpha - CS^1_\alpha - \psi\frac{d\Delta z^s}{d\alpha} \qquad \textbf{[3]}$$

Here we have a relationship between quota and design. If the quota goes up then we would expect the foreign firm to send relatively more lower grade cars since they would want to compete in the "fringe" market for lower

[17] The last two terms are consumer surplus before and after the import quota, respectively. See Appendix I for further description and derivation of equations in this section.

grade cars. This implies $\frac{d\overline{M}}{d\alpha} < 0$. A welfare neutral policy would change the inequality in **[3]** to an equality. In this case we have:

$$0 < \overline{M} <= \frac{CS^1_{\alpha} - CS^0_{\alpha} + \psi\frac{d\Delta z^s}{d\alpha}}{\lambda_{\alpha}} \qquad \textbf{[4]}$$

$$CS^1_{\overline{M}} > \lambda + \lambda_{\overline{M}} \qquad \textbf{[5]}$$

The numerator in **[4]** suggests that the bounds on VER depends on the rate of change of the difference in consumer surplus relative to the design of foreign cars, and the domestic firm's profit and market share times the rate of change of substitution relative to car design. In the denominator, it depends on the rate of quota rent accrual to foreign firms relative to foreign car design. The bound intuitively suggests that if a VER is to be at least welfare neutral then it must not exceed the limit shown. If it does, then the substitution effect diminishes and domestic firms get less of the "residual demand" induced by the VER (see Figure 3, in Appendix) This in turn triggers smaller market share and profits. When this is compared to the welfare loss due to quota rents and decreased consumer surplus, there can be a net social welfare loss. The result **[4]** of this section provides a decision rule for policy. If VERs are below the upper bound, then domestic welfare is improving otherwise it decreases above the boundary. The relation in **[5]** implies that the rate of change of consumer surplus when a VER is in effect must exceed the foreign firms price markup and the rate of change of this markup relative to the VER. Intuitively, this means that as long as consumer surplus is growing at a faster rate than price markup there is some welfare improvement[18].

Perhaps a more insiduous aspect of this boundary conditions in **[4]** and **[5]** stems from the fact that domestic industry lobbyist can use the

[18] After this paper wasw written, Berry, et al (1999) reported mixed results from an empirical analysis of VERs in the U.S. automobile industry. See also, Benjamin (1999) who summarized Berry, et al and emphasized the welfare loss aspects. None of those papers setforth conditions under which a VER could be welfare improving as is done here.

veil of a quota to increase the domestic price levels so that their heretofore overpriced cars would be priced to reflect higher domestic price levels. That is, a bottom up approach to automobile pricing can be generated here. If domestic cars are over priced then lobbyist can invoke a quota on foreign competetion to make the domestic price level come up to par with the over priced car. In a non-distorted economy, the burden would be put on the domestic producer to produce lower priced cars in order to be competitive. The assumptions and inferences derived thus far can be formally stated as follows:

PROPOSITION: *Let $X(z(\alpha))$ be a composite good with an N-vector of characteristic features $z(\alpha)$, where α is a design parameter. Define ΔCS_α as the rate of change of the difference in consumer surplus relative to the design parameter. Let λ be the mark-up of the price of X over marginal cost. ΔX^S is the amount of X that is substituted when the price of X changes. Assume that there are imperfect substitutes for X available in the domestic market. If an import quota $\overline{M}$ is chosen such that* $0 < \overline{M} \leq \frac{\Delta CS_\alpha + \psi \frac{d\Delta X^S}{d\alpha}}{\lambda_\alpha}$ *and* $CS^1_{\overline{M}} > \lambda + \lambda_{\overline{M}}$ *where ψ is a proportionality constant, and λ_α is the rate of change of quota rent accrued to foreign firms, then there is a net social welfare gain $W_N = W_G^* - W_L^*$* [19] *provided the following necessary conditions*[20] *exist*:

(i) Consumers have quasi-convex preferences and are non-satiated in quality,
(ii) Foreign supply of competing goods are totally elastic over the import horizon,
(iii) Domestic and foreign firms have neoclassical cost and production functions. □

IV. SUMMARY

[19] See prior definition of W^*.

[20] It may be possible to prove this proposition under more general and rigrous conditions.

IMPORT QUOTAS AND THE SUBSTITUTION EFFECT

This paper presented a stylized model of naive protectionist policy in the form of an import quota. Many policy makers argue that domestic social welfare would be improved if import quotas are imposed on those goods for which domestic goods are at a competitive disadvantage. A necessary condition for this policy to be effective was determined and it was found to be intuitively appealing. However, the result may not be very stable since it depends on an unobservable substitution effect. A more comprehensive treatment of the topics in this paper would entail a more detailed development of the market structure in which this trade policy is to be implemented. Helpman & Krugman (1989) have shown that when this is done the results can be ambiguous.

Empirical implementation of the ideas expressed in this paper should be mindful of the pitfalls inherent in hedonic regressions which may be used to estimate demand equations (see Anderson (1985), Atkinson & Halvorsen (1984), Blackley, et al (1984), Epple (1987)). Bresnahan (1981) outlined an alternative procedure relative to "pure" hedonic regressions. Estimation of the substitution effect proceeds by estimating the price-quality relationship for Japanese cars and US made cars with and without the VER. The "competing models" equation should show that the parameter estimates for the coefficients of the Japanese price-quality relationship are uniformly lower than those for domestic substitutes[21]. The difference between an estimate of demand for Japanese cars without a VER and an estimate for Japanese cars with VER would estimate the substitution effect. One would intuitively expect to see an upward shift of the price-quality relation after the VER is imposed. If this is bourne out then there would be strong evidence in favor of the well know result that quality is not invariant across markets when VERs are imposed. If the results of the empirical procedures are promising then the model could be applied to a full range of products in order to estimate the total impact on social welfare in the macro-economy.

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[21] According to theory, these coefficients represent the marginal prices of the corresponding quality variables under an appropriate specification. If Japanese firms offer similar or more features than domestic firms and the price of their product is less, then one would expect the marginal price of features to be less.

APPENDIX I

Consumer equations

Let $U(\mathbf{z}, z_0) = \left(\sum_j z_j^{\sigma}\right)^{\theta} + z_0$, $0<\theta<1$, $0<\sigma<1$.

In equilibrium, MRS $= \dfrac{\frac{dU(.)}{dz_i}}{\frac{dU(.)}{dz_0}} = \dfrac{p_j}{p_0}$, $p_0 = 1$ and $\dfrac{dU(.)}{dz_0}$ is normalized to unity.

$$p_j = \frac{dU(.)}{dz_i} = \sigma u'(.) z_j^{\sigma-1} \qquad \textbf{[1]}$$

Let $v_j = z_j^{\sigma-1}$ and $\mathbf{v} = \sum_j v_j$ so that $U(\mathbf{z}, z_0) = u(\mathbf{v}) + z_0$

From **[1]**, $p_j z_j = (\sigma U'(.) z_j^{\sigma-1}) z_j = \sigma u'(.) z_j^{\sigma} = \rho(\mathbf{v}) v_j$ **[2]**

$$p(\mathbf{z}) = \sum_j p_j z_j = \sum_j \rho(\mathbf{v}) v_j \qquad \textbf{[3]}$$

Equation **[1]** describes the marginal rate of substitution between a given characteristic and the numeraire good in consumer equilibrium. Equation **[3]** is the inverse demand function for quality in imported goods. It is a hedonic price index comprised of the incremental amount of income (**[2]**) which comsumers may want to spend for additional features. In **[2]**, $\rho(\mathbf{v})$ is the demand for characteristics.

Firm equations

The foreign firm faces a pre-VER demand $p(\mathbf{z}(\alpha), y)$ and a cost curve ,$C(.)$, such that $C_M > 0$, and $C_{MM} > 0$. The firm's problem is as follows:

$$\max \pi(.) = p(\mathbf{z}(\alpha), y)M - C(M, \mathbf{z}(\alpha))$$

$$\text{s.t } M <= \overline{M} \quad [22]$$

[22] This is the import quota constraint equation.

The first order conditions for profit maximization leads to the following equations[23]:

$$p_Z(z,y;\overline{M}) = \frac{C_Z(\overline{M},\mathbf{z}(\boldsymbol{\alpha}))}{\overline{M}} \qquad \textbf{[4]}$$

$$p(\mathbf{z}(\boldsymbol{\alpha}),y;\overline{M}) = C_M(\overline{M},\mathbf{z}(\boldsymbol{\alpha})) + \lambda \qquad \textbf{[5]}$$

where λ is the quota rent for foreign firms or the markup of price over marginal cost. The corresponding equations for domestic firms replace the VER, $\overline{M}$, with, M_d; λ with λ_d and the domestic design parameter α_d replaces α.

Welfare equations

$$W_L = \lambda\overline{M} + (CS(p(z,y) - CS(p(z,y;\overline{M})) \qquad \textbf{[6]}$$

The first term on the right of **[6]** is the quota rents that accrue to foreign firms. The second term is the decrease in consumer surplus[24].

$$W_G = \beta\Delta z^S(.;\overline{M})(p(\mathbf{z}(\boldsymbol{\alpha}_d),y;M_d) - C_{Md}(M_d,\mathbf{z}(\boldsymbol{\alpha}_d)) = \beta\Delta z^S(.;\overline{M})\lambda_d \qquad \textbf{[7]}$$

The first term on the right of **[7]** represents the amount of automobiles that will be purchased from domestic industries due to the substitution effect. The second term (enclosed in brackets) represents the rent that accrue to the domestic firm as a result of the increase in demand. We assume that firms are identical without loss of generality so that each firm gets an equal share of the rent in equilibrium. W_L^* and W_G^* correspond to optimal values of $p(z^*(\boldsymbol{\alpha}))$, y^* and $C(M,z^*(\boldsymbol{\alpha}))$ and describe the post optimality welfare locus shown in Appendix II, Figure 2.

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[23] See Feenstra (1988), pp 133

[24] Consumer surplus, CS(), can be expressed as a function of price or quantity. This is a direct extension of the Hurwicz-Uzawa (1971) Indirect Utility function theorem.

$$dW_G^* = dW_L^* \text{ implies: } \frac{d\overline{M}}{d\alpha} = \frac{\overline{M}\lambda_\alpha + CS^0_\alpha - CS^1_\alpha - \psi\frac{d\Delta z^S}{d\alpha}}{\psi\frac{d\Delta z^S}{d\overline{M}} - \lambda - \lambda_{\overline{M}} + CS^1_{\overline{M}}} = \frac{\phi(\overline{M},\alpha)}{\mu(\overline{M},\alpha)}$$

[8]

Here, $\phi(.)$ and $\mu(.)$ are the numerator and denominator of **[8]**. If $\frac{d\overline{M}}{d\alpha} <= 0$, then **(i)** either $\phi <= 0$ and $\mu > 0$ **or (ii)** $\phi >= 0$ and $\mu < 0$.

Case **(i)**:

$$\phi <= 0 \text{ implies: } 0 < \overline{M} <= \frac{CS^1_\alpha - CS^0_\alpha + \psi\frac{d\Delta z^S}{d\alpha}}{\lambda_\alpha} \qquad \textbf{[9]}$$

$$\mu > 0 \text{ implies: } \psi\frac{d\Delta z^S}{d\overline{M}} - \lambda - \lambda_{\overline{M}} + CS^1_{\overline{M}} > 0 \Rightarrow CS^1_{\overline{M}} > \lambda + \lambda_{\overline{M}}$$

[10]

The relation in **[10]** holds because $\psi > 0$ and $\frac{d\Delta z^S}{d\overline{M}} < 0$ [25].

Case **(ii)**:

In this case the inequalities in **[9]** and **[10]** are reversed. The reversal of **[9]** implies no quota and corresponds to free trade. In Figure 3, Appendix II, this corresponds to $\overline{\mathbf{m}} = 0$ and domestic firms will be forced to charge a price p_w in order to be competitive.

[25] The substitution effect decreases as the quota increases.

APPENDIX II

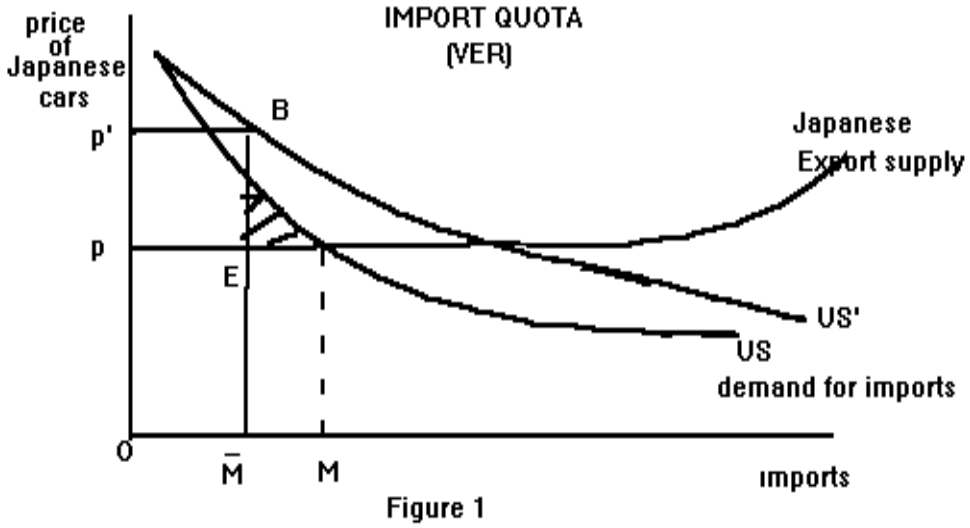


Figure 1

Source: Adapted from *Modern International Economics*, Ethier, Wilfred J., pp 185.

Figure 1 shows the demand shift induced by the VER, $\overline{M}$. US' is the demand curve for higher quality cars. US is the pre-VER demand curve, ostensibly for lower quality cars. The supply curve is flat over the region where Japanese firms can supply cars at a constant price as long as capacity permits. The quota rent that accrue to Japanese firms as a result of the VER is given by the area pEBp'. The decrease in consumer surplus is the area bounded by pp' and the US demand curve.

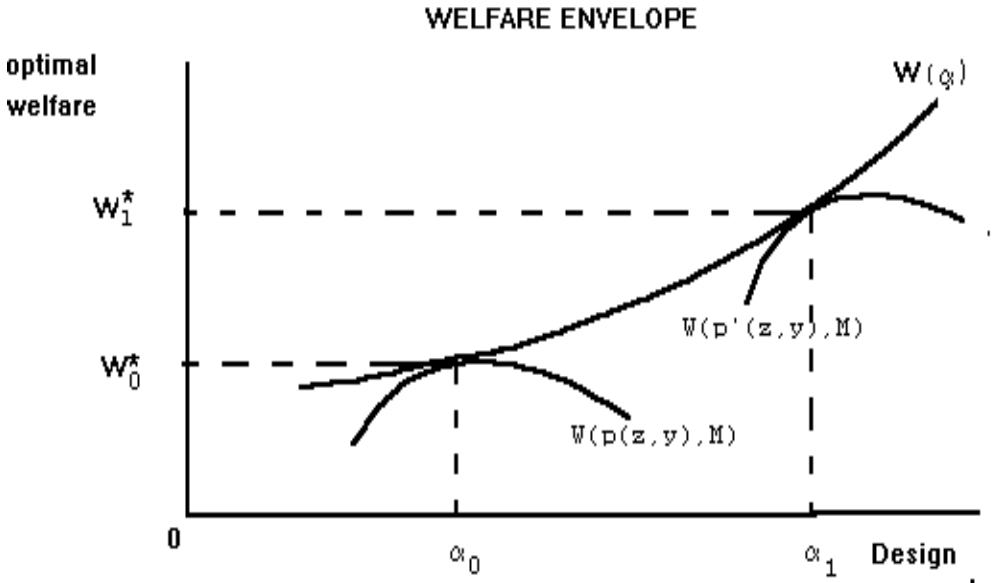
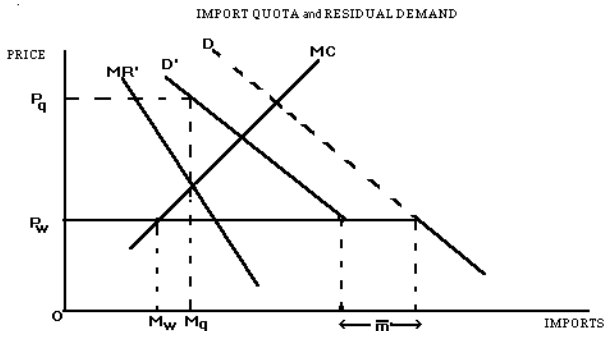


Figure 2

effect. The VER induces an improvement in the design parameter from α_0 to α_1. This implies a higher quality and higher priced automobile. Net welfare gain is depicted by W^*.

IMPORT QUOTAS AND THE SUBSTITUTION EFFECT



SOURCE: Adapted from Trade Policy and Market Structure, Elhanan Helpman & Paul Krugman, pg 31

The diagram shows the residual demand D' that is induced by the import quota $\overline{\mathbf{m}}$. The free trade or pre-quota price is given by P_W. For prices below P_W the domestic demand curve switches to D. If policy makers know the slope of the residual demand curve they can accept a quota (VER) that lies within the defined bounds. Domestic firms are free to maximize profits over the residual demand curve D'. The profit maximizing firm will choose to produce M_q.

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